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DETERMINATION OF REQUIRED OZONE DOSAGE IN FRESHWATER PILOT RECIRCULATING AND OZONE EFFECT ON WATER QUALITY PARAMETERS

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The water quality in intense recirculating aquaculture systems (RAS) is characterised by an accumulation of pollutants, potentially allowing fish pathogens to grow. Ozone has been implemented as a secondary water treatment technology improving water quality. Excess of ozone (overdosing) has detrimental effects on fish, and therefore, it is crucial to define the ozone demand of a specific RAS. This study aimed to develop a method to predict the ozone demand and to pursue a more direct approach to control the delivered ozone dosage in RASs.

RAS water samples were collected from a pilot-scale RAS, operated as an intensive commercial RAS subsequently subjected to ozonation. Several ozone dosages were spiked repeatedly upon ozone depletion, into RAS water to investigate ozone reactivity and its lifetime in the specific water matrix. All samples, including the control, were measured with a fluorimeter to define the ozone effect on natural fluorescence degradation. The predicted optimal ozone dosages were then applied in side-stream to pilot-RAS systems in which trouts were farmed to compare if the prediction of the effect of continuous ozone dosage complied with a RAS with constant daily feed and water exchange.

Three ozone dosages, including a control (non-ozonated), were selected to be tested in pilot-RAS (Fig. 1). Prior to ozonation, the organic matter accumulation due to fish activity was monitored for 195 days and was expressed as fluorescence intensity (blue line; Fig. 1a). The ozonation trials lasted seven days utilising one RAS per dosage (low, medium, high). The test levels ranged from 52-130 mg O₃/h, equivalent to 10-25 g O₃/kg feed. The fluorescence, indicative of organic matter content, was analysed over a period of 200 days. The highest concentration of injected ozone into the systems led to the highest fluorescence degradation (Fig. 1a). A significant decrease in bacteria load was observed even when the lowest ozone dosage was applied (Fig. 1b).

The method applied to predict the optimal ozone dosage of pilot-RAS based on laboratory studies was efficient and fluorescence found to be a good indicator of organic matter removal with the potential to be the basis of a robust and low cost ozone dosage control.

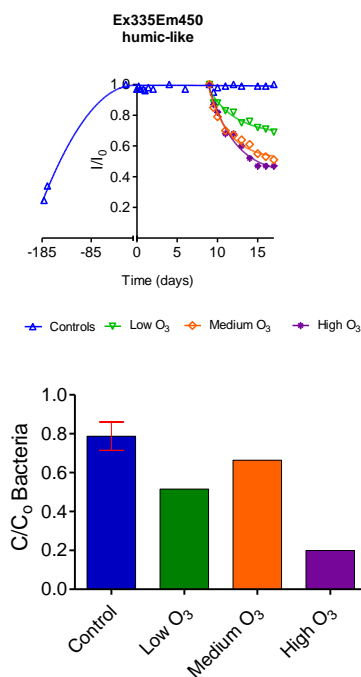


Figure 1: Effect of ozone on a) humic-like fluorescence degradation and b) bacteria load.